Citation:

Taylor EF, Burley VJ, Greenwood DC, Cade JE. Meat consumption and risk of breast cancer in the UK Women's Cohort Study. Br J Cancer. 2007 Apr 10;96(7):1139-46. Erratum in: Br J Cancer. 2007 Jun 4;96(11):178

PubMed ID: 17406351

Study Design:

Prospective Cohort Study

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To assess the effect of meat consumption and meat type on the risk of breast cancer in the UK Women's Cohort Study

Inclusion Criteria:

- age 35 to 69 years at baseline

Exclusion Criteria:

- for this analysis,
  - women with extremely high (>6000 kcal) or low (<500 kcal) energy intake
  - women with prevalent breast cancer

Description of Study Protocol:

Recruitment

- responders to a direct mail survey of the World Cancer Research Fund
  - 75% of responders agreed to complete a more detailed survey

Design: prospective cohort study

Blinding used (if applicable): N/A

Intervention (if applicable): N/A

© 2012 USDA Evidence Analysis Library. Printed on: 09/23/12

Statistical Analysis

- Survival analysis: using Cox regression weighted by the inverse of the probability of being sampled to take into account the large proportion of vegetarians in the cohort
    - time variable: time in the study (person years)
        - calculated as the time from the date of the questionnaire was filled in until either a report of incident breast cancer, death, or the censor date of the analysis, whichever came first
    - 2 models:
        - Model 1: adjusted for age and energy intake (split into quartiles)
        - Model 2: adjusted for age, energy intake, body mass index (BMI) (continuous), parity (no children, 1-2 children, 3-4 children and 5+ children), and combined fruit and vegetable consumption (split into quartiles)
            - smoking status, hormone replacement therapy use (HRT) and oral contraceptive pill use were also included (present, past or never)
            - additional confounders: socioeconomic class (professional and managerial, intermediate, and routine and manual), level of educational qualifications gained
            - Fractional polynomicals: to fit a smooth curve to t he relationship between breast cancer and total meat intake in Model 2
    - pre- and postmenopausal breast cancer treated independently after an initial analysis confirmed a modifying effect of menopausl status
    - proportional hazards assumption checked using graphical methods of log-log curves and Schoenfeld goodness of fit tests, which confirmed hazards were proportional
    - sensitivity analyses conducted
        - excluding vegetarians
        - excluding women with cancer incident within 1 year of entry to the study
        - to assess the model building strategy
        - excluding women aged 48 to 55 years of age, whose menopausal status may have been ambiguous
        - excluding HRT users

Data Collection Summary:

Timing of Measurements

- baseline data collected between 1995 and 1998
- investigation censor date: October 31, 2004

Dependent Variables

- incidence of breast cancer: flagged on the NHS central register

Independent Variables

- red meat: beef, pork, lamb, veal and other meat in mixed dishes
- poultry: roast, chicken, chicken slices, bread crumbed chicken, chicken or turkey in cream sauce, and chicken curry
- offal: organ meats
- processed meat: bacon, ham, corned beef, spam, luncheon meats, sausages, pies, pasties, sausage rolls, liver pate, salami, and meat pizza

© 2012 USDA Evidence Analysis Library. Printed on: 09/23/12

- total meat: sum of red meat, poultry, offal, and processed meat

Control Variables

Description of Actual Data Sample:

Initial N:

- Number of responders to initial mailing: N = 500,000
- Number in study: N = 33,725

Age: at baseline, mean (SD) = 52 (9) years

Ethnicity: not specified

Other relevant demographics:

- 27% educated to degree level
- 63% worked in professional or managerial positions

Anthropometrics

- BMI mean (SD) = 24.5 (4.4) kg/m^2

Location: United Kingdom (UK)

Summary of Results:

Subjects

- 11% were smokers
- 52% consumed alcohol more than once a week
- 88% did not use full-fat milk
- non-meat consumers were younger, more physically active, had a lower BMI
- high meat consumers (>103 g/day) were more likely to be smokers, had the highest total energy intake, highest mean BMI, highest proportion with no education beyond age 14, and lowest proportion employed in professional or managerial occupations
- medium meat (62 to 103 g/day) consumers were most likely to be low (<400g/day) fruit and vegetable consumers
- low meat consumers (<62 g/day) had the lowest energy intake

Associations between meat consumption and premenopausal breast cancer (see Table 1)

- Risk of breast cancer increased with consumption of total meat in Model 2 (more complex model)
  - HR = 1.2, 95% CI: 0.86 - 1.68) for high consumers vs non-consumers
  - estimated relative risk (RR) for an increase in total meat consumption of 50 g/day^{-1} = 1.12, 95%CI: 1.02 - 1.23, P trend = 0.02
- non-processed meat consumption was positively associated with risk
  - HR = 1.2, 95% CI: 0.86 - 1.6 for high vs non-consumers
  - RR per 50 g/day^{-1} = 1.13, 95% CI: 1.01 - 1.26, P trend = 0.03

© 2012 USDA Evidence Analysis Library. Printed on: 09/23/12

- processed meat intake was not significantly associated with risk of breast cancer, although the risk in high consumers was similar to that observed in non-processed meat
- association between red meat consumption and breast cancer risk was borderline significant, but showed largest effect size
    - HR = 1.32, 95% CI: 0.93 - 1.88 for high vs non-consumers
    - RR per 50 g/day^{-1} = 1.13, 95% CI: 0.99 = 1.29, P trend = 0.08

Association between meat consumption and postmenopausal breast cancer (see Table 2)

- There were slight positive trends observed across the low, medium and high meat categories, with a more marked difference between non-consumers and consumers.
- dividing low consumers into 'low' and 'very low' strengthened the dose response relationship with meat consumption
- total meat intake was positively associated with postmenopausal breast cancer
    - HR = 1.63, 95%CI: 1.10 - 2.30 for high vs non-consumers
    - RR per 50 g/day^{-1} = 1.10, 95% CI: 1.01 - 1.20, P trend = 0.02
- relationships between processed meat and red meat, and postmenopausal breast cancer were signficant
    - processed meat
        - HR for high vs non-consumers = 1.64, 95% CI: 1.14 - 2.37
        - RR per 50 g/day^{-1} = 1.64, 95% CI: 1.19 - 2.37, P trend = 0.003
    - red meat
        - HR for high vs non-consumers = 1.56, 95% CI: 1.09 - 1.26
        - RR per 50 g/day^{-1} = 1.12, 95% CI: 1.01 - 1.26, P trend = 0.04
- risks for the three meat types were similar when considering HRs in the categorical analysis
- fitting meat into model as a continuous predictor resulted in a stronger relationship with processed meat: RR per 50 g/day^{-1} = 1.64, 95% CI: 1.09 - 2.27, P trend = 0.003

Other Findings

- In premenopausal women:
    - HRs in the highest meat consumption category for Model 1 in premenopausal women were slightly lower than for Model 2 for all meat types except offal.
    - tests for trend were more significant in Model 2
- In postmenopausal women:
    - HRs were lower in Model 2
    - tests for trend becaome less significant with greater adjustments
- Fractional polynomials for total meat intake showed similar increasing risk with increasing total meatintake for both pre- and postmenopausal women, apart from premenopausal women with low meat intake who appear at lower risk than vegetarians
- Sensitivity analyses:
    - when vegetarians excluded, estimates were similar
    - when those with ambiguous menstrual status excluded, HRs and overall trends not substantially changed
    - when those with cancer within 1 year of entry were excluded, HRs and overall trends not substantially changed
    - when HRT users excluded from analysis of postmenopausal women, the relationship of meat intake with breast cancer risk was strengthened (data not shown)
    - no evidence of change in risk when meat consumption, cooking method and risk were investigated in Model 2.

© 2012 USDA Evidence Analysis Library. Printed on: 09/23/12

Author Conclusion:

Women who consume the most total meat, red meat and processed meat were at the highest risk for breast cancer compared with non-meat consumers, though red and processed meat were only significant in postmenopausal women, and non-processed meat was only significant in premenopausal women. Relationships between certain meats and breast cancer in both pre-and postmenopausal women merit further investigation.

Reviewer Comments:

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions		
1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	Yes
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes

Validity Questions		
1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes

© 2012 USDA Evidence Analysis Library. Printed on: 09/23/12

3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	Yes
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	N/A
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	N/A
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	N/A
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	N/A
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A

© 2012 USDA Evidence Analysis Library. Printed on: 09/23/12

5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes

© 2012 USDA Evidence Analysis Library. Printed on: 09/23/12

	8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
	8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
	8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
	8.6.	Was clinical significance as well as statistical significance reported?	Yes
	8.7.	If negative findings, was a power calculation reported to address type 2 error?	Yes
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**		Yes
	9.1.	Is there a discussion of findings?	Yes
	9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**		Yes
	10.1.	Were sources of funding and investigators' affiliations described?	Yes
	10.2.	Was the study free from apparent conflict of interest?	Yes

Copyright American Dietetic Association (ADA).

© 2012 USDA Evidence Analysis Library. Printed on: 09/23/12